

SEQUENCE LISTING

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Van Rie, Jeroen

Joos, Henk

<120> RECOMBINANT PLANT EXPRESSING NON-COMPETITIVELY BINDING Bt
INSECTICIDAL CRYSTAL PROTEINS

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<140> Div of 09/176,320

<141> Even date herewith

<150> PCT/EP90/00905

<151> 1990-05-30

<150> GB 89401499.2

<151> 1989-05-31

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Met Glu Ile Asn Asn Gln Asn Gln Cys Val

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Arg Leu Glu Thr Gly Asn Thr Val Ala Asp Ile Ser Leu Gly Leu Ile

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Asn Phe Leu Tyr Ser Asn Phe Val Pro Gly Gly Phe Ile Val Gly

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Leu Leu Glu Leu Ile Trp Gly Phe Ile Gly Pro Ser Gln Trp Asp Ile

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Phe Leu Ala Gln Ile Glu Gln Leu Ile Ser Gln Arg Ile Glu Glu Phe

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gct agg aat cag gca att tca aga ttg gag ggg cta agc aat ctt tat 581

Ala Arg Asn Gln Ala Ile Ser Arg Leu Glu Gly Leu Ser Asn Leu Tyr

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Lys Val Tyr Val Arg Ala Phe Ser Asp Trp Glu Lys Asp Pro Thr Asn

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Thr Asn His Cys Val Asp Thr Tyr Asn Gln Gly Leu Arg Arg Leu Glu

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Gly Arg Phe Leu Ser Asp Trp Ile Val Tyr Asn Arg Phe Arg Arg Gln

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ttg aca att tca gta tta gat att gtt gcg ttt ttt cca aat tat gat 1013

Leu Thr Ile Ser Val Leu Asp Ile Val Ala Phe Phe Pro Asn Tyr Asp

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Tyr Leu Asp Leu Pro Phe Ile Asn Gln Asn Leu Ser Pro Ala Ala Ser

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Thr Glu Arg Pro Val Thr Ile Thr Ala Ser Pro Ser Val Pro Ile Phe

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Arg Thr Leu Ser Tyr Ile Thr Gly Leu Asp Asn Ser Asn Pro Val Ala

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Pro Thr Tyr Leu Tyr Gln Lys Ile Asp Glu Ser Lys Leu Lys Ala Tyr

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acc cgt tat caa tta aga ggg tat atc gaa gat agt caa gac tta gaa 2501

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Ile Tyr Leu Ile Arg Tyr Asn Ala Lys His Glu Ile Val Asn Val Pro

750 755 760

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765 770 775

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Cys Gly Glu Pro Asn Arg Cys Ala Pro His Leu Glu Trp Asn Pro Asp

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Leu His Cys Ser Cys Arg Asp Gly Glu Lys Cys Ala His His Ser His

795 800 805 810

cat ttc tct ttg gac att gat gtt gga tgt aca gac tta aat gag gac 2741

His Phe Ser Leu Asp Ile Asp Val Gly Cys Thr Asp Leu Asn Glu Asp

815 820 825

tta ggt gta tgg gtg ata ttc aag att aag acg caa gat ggc cac gca 2789

Leu Gly Val Trp Val Ile Phe Lys Ile Lys Thr Gln Asp Gly His Ala

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Glu Thr Leu Gln Leu Glu Thr Thr Ile Val Tyr Lys Glu Ala Lys Glu

875 880 885 890

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925 930 935

gcg gct att ttt gaa gaa tta gaa gag cgt att ttc act gca ttt tcc 3125

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940 945 950

cta tat gat gcg aga aat att att aaa aat ggc gat ttc aat aat ggc 3173

Leu Tyr Asp Ala Arg Asn Ile Ile Lys Asn Gly Asp Phe Asn Asn Gly

955 960 965 970

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Met Glu Glu

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Thr Val Ala Asp Ile Ser Leu Gly Leu Ile Asn Phe Leu Tyr Ser Asn

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Phe Val Pro Gly Gly Phe Ile Val Gly Leu Leu Glu Leu Ile Trp

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Gly Phe Ile Gly Pro Ser Gln Trp Asp Ile Phe Leu Ala Gln Ile Glu

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Gln Leu Ile Ser Gln Arg Ile Glu Glu Phe Ala Arg Asn Gln Ala Ile

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Ser Arg Leu Glu Gly Leu Ser Asn Leu Tyr Lys Val Tyr Val Arg Ala

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Phe Ser Asp Trp Glu Lys Asp Pro Thr Asn Pro Ala Leu Arg Glu Glu

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Met Arg Ile Gln Phe Asn Asp Met Asn Ser Ala Leu Ile Thr Ala Ile

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Val Gln Ala Ala Asn Leu His Leu Ser Ile Leu Arg Asp Val Ser Val

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Ser Asp Leu Thr Ser Leu Ile His Val Tyr Thr Asn His Cys Val Asp

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Thr Tyr Asn Gln Gly Leu Arg Arg Leu Glu Gly Arg Phe Leu Ser Asp

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Trp Ile Val Tyr Asn Arg Phe Arg Arg Gln Leu Thr Ile Ser Val Leu

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Asp Ile Val Ala Phe Phe Pro Asn Tyr Asp Ile Arg Thr Tyr Pro Ile

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Gln Thr Ala Thr Gln Leu Thr Arg Glu Val Tyr Leu Asp Leu Pro Phe

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Ile Asn Gln Asn Leu Ser Pro Ala Ala Ser Tyr Pro Thr Phe Ser Ala

275 280 285

Ala Glu Ser Ala Ile Ile Arg Ser Pro His Leu Val Asp Phe Leu Asn

290 295 300

Ser Phe Thr Ile Tyr Thr Asp Ser Leu Ala Arg Tyr Ala Tyr Trp Gly

305 310 315 320

Gly His Leu Val Asn Ser Phe Arg Thr Gly Thr Thr Asn Leu Ile

325 330 335

Arg Ser Pro Leu Tyr Gly Arg Glu Gly Asn Thr Glu Arg Pro Val Thr

340 345 350

Ile Thr Ala Ser Pro Ser Val Pro Ile Phe Arg Thr Leu Ser Tyr Ile

355 360 365

Thr Gly Leu Asp Asn Ser Asn Pro Val Ala Gly Ile Glu Gly Val Glu

370 375 380

Phe Gln Asn Thr Ile Ser Arg Ser Ile Tyr Arg Lys Ser Gly Pro Ile

385 390 395 400

Asp Ser Phe Ser Glu Leu Pro Pro Gln Asp Ala Ser Val Ser Pro Ala

405 410 415

Ile Gly Tyr Ser His Arg Leu Cys His Ala Thr Phe Leu Glu Arg Ile

420 425 430

Ser Gly Pro Arg Ile Ala Gly Thr Val Phe Ser Trp Thr His Arg Ser

435 440 445

Ala Ser Pro Thr Asn Glu Val Ser Pro Ser Arg Ile Thr Gln Ile Pro

450 455 460

Trp Val Lys Ala His Thr Leu Ala Ser Gly Ala Ser Val Ile Lys Gly

465 470 475 480

Pro Gly Phe Thr Gly Gly Asp Ile Leu Thr Arg Asn Ser Met Gly Glu

485 490 495

Leu Gly Thr Leu Arg Val Thr Phe Thr Gly Arg Leu Pro Gln Ser Tyr

500 505 510

Tyr Ile Arg Phe Arg Tyr Ala Ser Val Ala Asn Arg Ser Gly Thr Phe

515 520 525

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545 550 555 560

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565 570 575

Ile Gln Ser Gly Val Tyr Ile Asp Arg Ile Glu Phe Ile Pro Val Thr

580 585 590

Ala Thr Phe Glu Ala Glu Tyr Asp Leu Glu Arg Ala Gln Lys Val Val

595 600 605

Asn Ala Leu Phe Thr Ser Thr Asn Gln Leu Gly Leu Lys Thr Asp Val

610 615 620

Thr Asp Tyr His Ile Asp Gln Val Ser Asn Leu Val Ala Cys Leu Ser

625 630 635 640

Asp Glu Phe Cys Leu Asp Glu Lys Arg Glu Leu Ser Glu Lys Val Lys

645 650 655

His Ala Lys Arg Leu Ser Asp Glu Arg Asn Leu Leu Gln Asp Pro Asn

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Phe Arg Gly Ile Asn Arg Gln Pro Asp Arg Gly Trp Arg Gly Ser Thr

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Asp Ile Thr Ile Gln Gly Gly Asp Asp Val Phe Lys Glu Asn Tyr Val

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Pro Leu Ser Val Glu Asn Gln Ile Gly Pro Cys Gly Glu Pro Asn Arg

770 775 780

Cys Ala Pro His Leu Glu Trp Asn Pro Asp Leu His Cys Ser Cys Arg

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Asp Gly Glu Lys Cys Ala His His Ser His His Phe Ser Leu Asp Ile

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Asp Val Gly Cys Thr Asp Leu Asn Glu Asp Leu Gly Val Trp Val Ile

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Ile Ile Lys Asn Gly Asp Phe Asn Asn Gly Leu Leu Cys Trp Asn Val

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Lys Gly His Val Glu Val Glu Glu Gln Asn Asn His Arg Ser Val Leu

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Val Ile Pro Glu Trp Glu Ala Glu Val Ser Gln Glu Val Arg Val Cys

995 1000 1005

Pro Gly Arg Gly Tyr Ile Leu Arg Val Thr Ala Tyr Lys Glu Gly Tyr

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gta cca ggg gga gga ttt tta gtt gga tta ata gat ttt gta tgg gga 428

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tta att aat gaa aga ata gct gaa ttt gct agg aat gct gct att gct 524

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85

90

95

aat tta gaa gga tta gaa aac aat tta aat ata tat gtg gaa gca ttt 572

Asn Leu Glu Gly Leu Glu Asn Asn Leu Asn Ile Tyr Val Glu Ala Phe

100

105

110

aaa gaa tgg gaa gaa gat cct aat aat cca gaa acc agg acc aga gta 620

Lys Glu Trp Glu Glu Asp Pro Asn Asn Pro Glu Thr Arg Thr Arg Val

115

120

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att gat cgc ttt cgt ata ctt gat ggg cta ctt gaa agg gac att cct 668

Ile Asp Arg Phe Arg Ile Leu Asp Gly Leu Leu Glu Arg Asp Ile Pro

130

135

140

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tcg ttt cga att tct gga ttt gaa gta ccc ctt tta tcc gtt tat gct 716

Ser Phe Arg Ile Ser Gly Phe Glu Val Pro Leu Leu Ser Val Tyr Ala

150

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160

caa gcg gcc aat ctg cat cta gct ata tta aga gat tct gta att ttt 764

Gln Ala Ala Asn Leu His Leu Ala Ile Leu Arg Asp Ser Val Ile Phe

165

170

175

gga gaa aga tgg gga ttg aca acg ata aat gtc aat gaa aac tat aat 812

Gly Glu Arg Trp Gly Leu Thr Thr Ile Asn Val Asn Glu Asn Tyr Asn

180

185

190

aga cta att agg cat att gat gaa tat gct gat cac tgt gca aat acg 860

Arg Leu Ile Arg His Ile Asp Glu Tyr Ala Asp His Cys Ala Asn Thr

195

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tat aat cgg gga tta aat aat tta ccg aaa tct acg tat caa gat tgg 908

Tyr Asn Arg Gly Leu Asn Asn Leu Pro Lys Ser Thr Tyr Gln Asp Trp

210

215

220

225

ata aca tat aat cga tta cgg aga gac tta aca ttg act gta tta gat 956

Ile Thr Tyr Asn Arg Leu Arg Asp Leu Thr Leu Thr Val Leu Asp

230

235

240

atc gcc get ttc ttt cca aac tat gac aat agg aga tat cca att cag 1004

Ile Ala Ala Phe Phe Pro Asn Tyr Asp Asn Arg Arg Tyr Pro Ile Gln

245

250

255

cca gtt ggt caa cta aca agg gaa gtt tat acg gac cca tta att aat 1052

Pro Val Gly Gln Leu Thr Arg Glu Val Tyr Thr Asp Pro Leu Ile Asn

260 265 270

ttt aat cca cag tta cag tct gta gct caa tta cct act ttt aac gtt 1100

Phe Asn Pro Gln Leu Gln Ser Val Ala Gln Leu Pro Thr Phe Asn Val

275 280 285

atg gag agc agc gca att aga aat cct cat tta ttt gat ata ttg aat 1148

Met Glu Ser Ser Ala Ile Arg Asn Pro His Leu Phe Asp Ile Leu Asn

290 295 300 305

aat ctt aca atc ttt acg gat tgg ttt agt gtt gga cgc aat ttt tat 1196

Asn Leu Thr Ile Phe Thr Asp Trp Phe Ser Val Gly Arg Asn Phe Tyr

310 315 320

tgg gga gga cat cga gta ata tct agc ctt ata gga ggt ggt aac ata 1244

Trp Gly Gly His Arg Val Ile Ser Ser Leu Ile Gly Gly Asn Ile

325 330 335

aca tct cct ata tat gga aga gag gcg aac cag gag cct cca aga tcc 1292

Thr Ser Pro Ile Tyr Gly Arg Glu Ala Asn Gln Glu Pro Pro Arg Ser

340 345 350

ttt act ttt aat gga ccg gta ttt agg act tta tca aat cct act tta 1340

Phe Thr Phe Asn Gly Pro Val Phe Arg Thr Leu Ser Asn Pro Thr Leu

355

360

365

cga tta tta cag caa cct tgg cca gcg cca cca ttt aat tta cgt ggt 1388

Arg Leu Leu Gln Gln Pro Trp Pro Ala Pro Pro Phe Asn Leu Arg Gly

370

375

380

385

gtt gaa gga gta gaa ttt tct aca cct aca aat agc ttt acg tat cga 1436

Val Glu Gly Val Glu Phe Ser Thr Pro Thr Asn Ser Phe Thr Tyr Arg

390

395

400

gga aga ggt acg gtt gat tct tta act gaa tta ccg cct gag gat aat 1484

Gly Arg Gly Thr Val Asp Ser Leu Thr Glu Leu Pro Pro Glu Asp Asn

405

410

415

agt gtg cca cct cgc gaa gga tat agt cat cgt tta tgt cat gca act 1532

Ser Val Pro Pro Arg Glu Gly Tyr Ser His Arg Leu Cys His Ala Thr

420

425

430

ttt gtt caa aga tct gga aca cct ttt tta aca act ggt gta gta ttt 1580

Phe Val Gln Arg Ser Gly Thr Pro Phe Leu Thr Thr Gly Val Val Phe

435

440

445

tct tgg acg cat cgt agt gca act ctt aca aat aca att gat cca gag 1628

Ser Trp Thr His Arg Ser Ala Thr Leu Thr Asn Thr Ile Asp Pro Glu

450 455 460 465

aga att aat caa ata cct tta gtg aaa gga ttt aga gtt tgg ggg ggc 1676

Arg Ile Asn Gln Ile Pro Leu Val Lys Gly Phe Arg Val Trp Gly Gly

470 475 480

acc tct gtc att aca gga cca gga ttt aca gga ggg gat atc ctt cga 1724

Thr Ser Val Ile Thr Gly Pro Gly Phe Thr Gly Gly Asp Ile Leu Arg

485 490 495

aga aat acc ttt ggt gat ttt gta tct cta caa gtc aat att aat tca 1772

Arg Asn Thr Phe Gly Asp Phe Val Ser Leu Gln Val Asn Ile Asn Ser

500 505 510

cca att acc caa aga tac cgt tta aga ttt cgt tac gct tcc agt agg 1820

Pro Ile Thr Gln Arg Tyr Arg Leu Arg Phe Arg Tyr Ala Ser Ser Arg

515 520 525

gat gca cga gtt ata gta tta aca gga gcg gca tcc aca gga gtg gga 1868

Asp Ala Arg Val Ile Val Leu Thr Gly Ala Ala Ser Thr Gly Val Gly

530 535 540 545

ggc caa gtt agt gta aat atg cct ctt cag aaa act atg gaa ata ggg 1916

Gly Gln Val Ser Val Asn Met Pro Leu Gln Lys Thr Met Glu Ile Gly

550 555 560

gag aac tta aca tct aga aca ttt aga tat acc gat ttt agt aat cct 1964

Glu Asn Leu Thr Ser Arg Thr Phe Arg Tyr Thr Asp Phe Ser Asn Pro

565 570 575

ttt tca ttt aga gct aat cca gat ata att ggg ata agt gaa caa cct 2012

Phe Ser Phe Arg Ala Asn Pro Asp Ile Ile Gly Ile Ser Glu Gln Pro

580 585 590

cta ttt ggt gca ggt tct att agt agc ggt gaa ctt tat ata gat aaa 2060

Leu Phe Gly Ala Gly Ser Ile Ser Ser Gly Glu Leu Tyr Ile Asp Lys

595 600 605

att gaa att att cta gca gat gca aca ttt gaa gca gaa tct gat tta 2108

Ile Glu Ile Ile Leu Ala Asp Ala Thr Phe Glu Ala Glu Ser Asp Leu

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gaa aga gca caa aag gcg gtg aat gcc ctg ttt act tct tcc aat caa 2156

Glu Arg Ala Gln Lys Ala Val Asn Ala Leu Phe Thr Ser Ser Asn Gln

630 635 640

atc ggg tta aaa acc gat gtg acg gat tat cat att gat caa gta tcc 2204

Ile Gly Leu Lys Thr Asp Val Thr Asp Tyr His Ile Asp Gln Val Ser

645 650 655

aat tta gtg gat tgt tta tca gat gaa ttt tgt ctg gat gaa aag cga 2252

Asn Leu Val Asp Cys Leu Ser Asp Glu Phe Cys Leu Asp Glu Lys Arg

660 665 670

gaa ttg tcc gag aaa gtc aaa cat gcg aag cga ctc agt gat gag cgg 2300

Glu Leu Ser Glu Lys Val Lys His Ala Lys Arg Leu Ser Asp Glu Arg

675 680 685

aat tta ctt caa gat cca aac ttc aga ggg atc aat aga caa cca gac 2348

Asn Leu Leu Gln Asp Pro Asn Phe Arg Gly Ile Asn Arg Gln Pro Asp

690 695 700 705

cgt ggc tgg aga gga agt aca gat att acc atc caa gga gga gat gac 2396

Arg Gly Trp Arg Gly Ser Thr Asp Ile Thr Ile Gln Gly Gly Asp Asp

710 715 720

gta ttc aaa gag aat tac gtc aca cta ccg ggt acc gtt gat gag tgc 2444

Val Phe Lys Glu Asn Tyr Val Thr Leu Pro Gly Thr Val Asp Glu Cys

725

730

735

tat cca acg tat tta tat cag aaa ata gat gag tcg aaa tta aaa gct 2492

Tyr Pro Thr Tyr Leu Tyr Gln Lys Ile Asp Glu Ser Lys Leu Lys Ala

740

745

750

tat acc cgt tat gaa tta aga ggg tat atc gaa gat agt caa gac tta 2540

Tyr Thr Arg Tyr Glu Leu Arg Gly Tyr Ile Glu Asp Ser Gln Asp Leu

755

760

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gaa atc tat ttg atc cgt tac aat gca aaa cac gaa ata gta aat gtg 2588

Glu Ile Tyr Leu Ile Arg Tyr Asn Ala Lys His Glu Ile Val Asn Val

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775

780

785

cca ggc acg ggt tcc tta tgg ccg ctt tca gcc caa agt cca atc gga 2636

Pro Gly Thr Gly Ser Leu Trp Pro Leu Ser Ala Gln Ser Pro Ile Gly

790

795

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aag tgt gga gaa ccg aat cga tgc gcg cca cac ctt gaa tgg aat cct 2684

Lys Cys Gly Glu Pro Asn Arg Cys Ala Pro His Leu Glu Trp Asn Pro

805

810

815

gat cta gat tgt tcc tgc aga gac ggg gaa aaa tgt gca cat cat tcc 2732

Asp Leu Asp Cys Ser Cys Arg Asp Gly Glu Lys Cys Ala His His Ser

820 825 830

cat cat ttc acc ttg gat att gat gtt gga tgt aca gac tta aat gag 2780

His His Phe Thr Leu Asp Ile Asp Val Gly Cys Thr Asp Leu Asn Glu

835 840 845

gac tta ggt gta tgg gtg ata ttc aag att aag acg caa gat ggc cat 2828

Asp Leu Gly Val Trp Val Ile Phe Lys Ile Lys Thr Gln Asp Gly His

850 855 860 865

gca aga cta ggg aat cta gag ttt ctc gaa gag aaa cca tta tta ggg 2876

Ala Arg Leu Gly Asn Leu Glu Phe Leu Glu Glu Lys Pro Leu Leu Gly

870 875 880

gaa gca cta gct cgt gtg aaa aga gcg gag aag aag tgg aga gac aaa 2924

Glu Ala Leu Ala Arg Val Lys Arg Ala Glu Lys Lys Trp Arg Asp Lys

885 890 895

cga gag aaa ctg cag ttg gaa aca aat att gtt tat aaa gag gca aaa 2972

Arg Glu Lys Leu Gln Leu Glu Thr Asn Ile Val Tyr Lys Glu Ala Lys

900 905 910

gaa tct gta gat gct tta ttt gta aac tct caa tat gat aga tta caa 3020

Glu Ser Val Asp Ala Leu Phe Val Asn Ser Gln Tyr Asp Arg Leu Gln

915 920 925

gtg gat acg aac atc gcg atg att cat gcg gca gat aaa cgc gtt cat 3068

Val Asp Thr Asn Ile Ala Met Ile His Ala Ala Asp Lys Arg Val His

930 935 940 945

aga atc cgg gaa gcg tat ctg cca gag ttg tct gtg att cca ggt gtc 3116

Arg Ile Arg Glu Ala Tyr Leu Pro Glu Leu Ser Val Ile Pro Gly Val

950 955 960

aat gcg gcc att ttc gaa gaa tta gag gga cgt att ttt aca gcg tat 3164

Asn Ala Ala Ile Phe Glu Glu Leu Glu Gly Arg Ile Phe Thr Ala Tyr

965 970 975

tcc tta tat gat gcg aga aat gtc att aaa aat ggc gat ttc aat aat 3212

Ser Leu Tyr Asp Ala Arg Asn Val Ile Lys Asn Gly Asp Phe Asn Asn

980 985 990

ggc tta tta tgc tgg aac gtc aaa ggt cat gta gat gta gaa gag caa 3260

Gly Leu Leu Cys Trp Asn Val Lys Gly His Val Asp Val Glu Glu Gln

995 1000 1005

aac aac cac cgt tcg gtc ctt atc cca gaa tgg gag gca gaa gtg 3308

Asn Asn His Arg Ser Val Leu Val Ile Pro Glu Trp Glu Ala Glu Val

1010 1015 1020 1025

tca caa gag gtt cgt gtc tgt cca ggt cgt ggc tat atc ctt cgt gtc 3356

Ser Gln Glu Val Arg Val Cys Pro Gly Arg Gly Tyr Ile Leu Arg Val

1030 1035 1040

aca gca tat aaa gag gga tat gga gag ggc tgc gta acg atc cat gag 3404

Thr Ala Tyr Lys Glu Gly Tyr Gly Glu Gly Cys Val Thr Ile His Glu

1045 1050 1055

atc gaa gac aat aca gac gaa ctg aaa ttc agc aac tgt gta gaa gag 3452

Ile Glu Asp Asn Thr Asp Glu Leu Lys Phe Ser Asn Cys Val Glu Glu

1060 1065 1070

gaa gta tat cca aac aac aca gta acg tgt aat aat tat act ggg act 3500

Glu Val Tyr Pro Asn Asn Thr Val Thr Cys Asn Asn Tyr Thr Gly Thr

1075 1080 1085

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1090

1095

1100

1105

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1115

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1125

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1135

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Ser Asn Arg Gly Tyr Gly Asp Tyr Thr Pro Leu Pro Ala Gly Tyr Val

1140

1145

1150

aca aag gat tta gag tac ttc cca gag acc gat aag gta tgg att gag 3740

Thr Lys Asp Leu Glu Tyr Phe Pro Glu Thr Asp Lys Val Trp Ile Glu

1155

1160

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atc gga gaa aca gaa gga aca ttc atc gtg gat agc gtg gaa tta ctc 3788

Ile Gly Glu Thr Glu Gly Thr Phe Ile Val Asp Ser Val Glu Leu Leu

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1175

1180

1185

ctt atg gag gaa taa gatacgataaaatgtacaaataaagaatgat 3843

Leu Met Glu Glu

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<211> 1189

<212> PRT

<213> *Bacillus thuringiensis*

<400> 8

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Asn Pro Glu Glu Val Leu Leu Asp Gly Glu Arg Ile Ser Thr Gly Asn

20 25 30

Ser Ser Ile Asp Ile Ser Leu Ser Leu Val Gln Phe Met Val Ser Asn

35 40 45

Phe Val Pro Gly Gly Gly Phe Leu Val Gly Leu Ile Asp Phe Val Trp

50 55 60

Gly Ile Val Gly Pro Ser Gln Trp Asp Ala Phe Leu Val Gln Ile Glu

65 70 75 80

Gln Leu Ile Asn Glu Arg Ile Ala Glu Phe Ala Arg Asn Ala Ala Ile

85 90 95

Ala Asn Leu Glu Gly Leu Glu Asn Asn Leu Asn Ile Tyr Val Glu Ala

100 105 110

Phe Lys Glu Trp Glu Glu Asp Pro Asn Asn Pro Glu Thr Arg Thr Arg

115 120 125

Val Ile Asp Arg Phe Arg Ile Leu Asp Gly Leu Leu Glu Arg Asp Ile

130 135 140

Pro Ser Phe Arg Ile Ser Gly Phe Glu Val Pro Leu Leu Ser Val Tyr

145 150 155 160

Ala Gln Ala Ala Asn Leu His Leu Ala Ile Leu Arg Asp Ser Val Ile

165

170

175

Phe Gly Glu Arg Trp Gly Leu Thr Thr Ile Asn Val Asn Glu Asn Tyr

180

185

190

Asn Arg Leu Ile Arg His Ile Asp Glu Tyr Ala Asp His Cys Ala Asn

195

200

205

Thr Tyr Asn Arg Gly Leu Asn Asn Leu Pro Lys Ser Thr Tyr Gln Asp

210

215

220

Trp Ile Thr Tyr Asn Arg Leu Arg Arg Asp Leu Thr Leu Thr Val Leu

225

230

235

240

Asp Ile Ala Ala Phe Phe Pro Asn Tyr Asp Asn Arg Arg Tyr Pro Ile

245

250

255

Gln Pro Val Gly Gln Leu Thr Arg Glu Val Tyr Thr Asp Pro Leu Ile

260

265

270

Asn Phe Asn Pro Gln Leu Gln Ser Val Ala Gln Leu Pro Thr Phe Asn

275

280

285

Val Met Glu Ser Ser Ala Ile Arg Asn Pro His Leu Phe Asp Ile Leu

290 295 300

Asn Asn Leu Thr Ile Phe Thr Asp Trp Phe Ser Val Gly Arg Asn Phe

305 310 315 320

Tyr Trp Gly Gly His Arg Val Ile Ser Ser Leu Ile Gly Gly Asn

325 330 335

Ile Thr Ser Pro Ile Tyr Gly Arg Glu Ala Asn Gln Glu Pro Pro Arg

340 345 350

Ser Phe Thr Phe Asn Gly Pro Val Phe Arg Thr Leu Ser Asn Pro Thr

355 360 365

Leu Arg Leu Leu Gln Gln Pro Trp Pro Ala Pro Pro Phe Asn Leu Arg

370 375 380

Gly Val Glu Gly Val Glu Phe Ser Thr Pro Thr Asn Ser Phe Thr Tyr

385 390 395 400

Arg Gly Arg Gly Thr Val Asp Ser Leu Thr Glu Leu Pro Pro Glu Asp

405 410 415

Asn Ser Val Pro Pro Arg Glu Gly Tyr Ser His Arg Leu Cys His Ala

420 425 430

Thr Phe Val Gln Arg Ser Gly Thr Pro Phe Leu Thr Thr Gly Val Val

435 440 445

Phe Ser Trp Thr His Arg Ser Ala Thr Leu Thr Asn Thr Ile Asp Pro

450 455 460

Glu Arg Ile Asn Gln Ile Pro Leu Val Lys Gly Phe Arg Val Trp Gly

465 470 475 480

Gly Thr Ser Val Ile Thr Gly Pro Gly Phe Thr Gly Gly Asp Ile Leu

485 490 495

Arg Arg Asn Thr Phe Gly Asp Phe Val Ser Leu Gln Val Asn Ile Asn

500 505 510

Ser Pro Ile Thr Gln Arg Tyr Arg Leu Arg Phe Arg Tyr Ala Ser Ser

515 520 525

Arg Asp Ala Arg Val Ile Val Leu Thr Gly Ala Ala Ser Thr Gly Val

530 535 540

Gly Gly Gln Val Ser Val Asn Met Pro Leu Gln Lys Thr Met Glu Ile

545 550 555 560

Gly Glu Asn Leu Thr Ser Arg Thr Phe Arg Tyr Thr Asp Phe Ser Asn

565 570 575

Pro Phe Ser Phe Arg Ala Asn Pro Asp Ile Ile Gly Ile Ser Glu Gln

580 585 590

Pro Leu Phe Gly Ala Gly Ser Ile Ser Ser Gly Glu Leu Tyr Ile Asp

595 600 605

Lys Ile Glu Ile Ile Leu Ala Asp Ala Thr Phe Glu Ala Glu Ser Asp

610 615 620

Leu Glu Arg Ala Gln Lys Ala Val Asn Ala Leu Phe Thr Ser Ser Asn

625 630 635 640

Gln Ile Gly Leu Lys Thr Asp Val Thr Asp Tyr His Ile Asp Gln Val

645 650 655

Ser Asn Leu Val Asp Cys Leu Ser Asp Glu Phe Cys Leu Asp Glu Lys

660

665

670

Arg Glu Leu Ser Glu Lys Val Lys His Ala Lys Arg Leu Ser Asp Glu

675

680

685

Arg Asn Leu Leu Gln Asp Pro Asn Phe Arg Gly Ile Asn Arg Gln Pro

690

695

700

Asp Arg Gly Trp Arg Gly Ser Thr Asp Ile Thr Ile Gln Gly Gly Asp

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710

715

720

Asp Val Phe Lys Glu Asn Tyr Val Thr Leu Pro Gly Thr Val Asp Glu

725

730

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Cys Tyr Pro Thr Tyr Leu Tyr Gln Lys Ile Asp Glu Ser Lys Leu Lys

740

745

750

Ala Tyr Thr Arg Tyr Glu Leu Arg Gly Tyr Ile Glu Asp Ser Gln Asp

755

760

765

Leu Glu Ile Tyr Leu Ile Arg Tyr Asn Ala Lys His Glu Ile Val Asn

770 775 780

Val Pro Gly Thr Gly Ser Leu Trp Pro Leu Ser Ala Gln Ser Pro Ile

785 790 795 800

Gly Lys Cys Gly Glu Pro Asn Arg Cys Ala Pro His Leu Glu Trp Asn

805 810 815

Pro Asp Leu Asp Cys Ser Cys Arg Asp Gly Glu Lys Cys Ala His His

820 825 830

Ser His His Phe Thr Leu Asp Ile Asp Val Gly Cys Thr Asp Leu Asn

835 840 845

Glu Asp Leu Gly Val Trp Val Ile Phe Lys Ile Lys Thr Gln Asp Gly

850 855 860

His Ala Arg Leu Gly Asn Leu Glu Phe Leu Glu Glu Lys Pro Leu Leu

865 870 875 880

Gly Glu Ala Leu Ala Arg Val Lys Arg Ala Glu Lys Lys Trp Arg Asp

885 890 895

Lys Arg Glu Lys Leu Gln Leu Glu Thr Asn Ile Val Tyr Lys Glu Ala

900 905 910

Lys Glu Ser Val Asp Ala Leu Phe Val Asn Ser Gln Tyr Asp Arg Leu

915 920 925

Gln Val Asp Thr Asn Ile Ala Met Ile His Ala Ala Asp Lys Arg Val

930 935 940

His Arg Ile Arg Glu Ala Tyr Leu Pro Glu Leu Ser Val Ile Pro Gly

945 950 955 960

Val Asn Ala Ala Ile Phe Glu Glu Leu Glu Gly Arg Ile Phe Thr Ala

965 970 975

Tyr Ser Leu Tyr Asp Ala Arg Asn Val Ile Lys Asn Gly Asp Phe Asn

980 985 990

Asn Gly Leu Leu Cys Trp Asn Val Lys Gly His Val Asp Val Glu Glu

995 1000 1005

Gln Asn Asn His Arg Ser Val Leu Val Ile Pro Glu Trp Glu Ala Glu

1010 1015 1020

Val Ser Gln Glu Val Arg Val Cys Pro Gly Arg Gly Tyr Ile Leu Arg

025 1030 1035 1040

Val Thr Ala Tyr Lys Glu Gly Tyr Gly Glu Gly Cys Val Thr Ile His

1045 1050 1055

Glu Ile Glu Asp Asn Thr Asp Glu Leu Lys Phe Ser Asn Cys Val Glu

1060 1065 1070

Glu Glu Val Tyr Pro Asn Asn Thr Val Thr Cys Asn Asn Tyr Thr Gly

1075 1080 1085

Thr Gln Glu Glu Tyr Glu Gly Thr Tyr Thr Ser Arg Asn Gln Gly Tyr

1090 1095 1100

Asp Glu Ala Tyr Gly Asn Asn Pro Ser Val Pro Ala Asp Tyr Ala Ser

105 1110 1115 1120

Val Tyr Glu Glu Lys Ser Tyr Thr Asp Gly Arg Arg Glu Asn Pro Cys

1125 1130 1135

Glu Ser Asn Arg Gly Tyr Gly Asp Tyr Thr Pro Leu Pro Ala Gly Tyr

1140

1145

1150

Val Thr Lys Asp Leu Glu Tyr Phe Pro Glu Thr Asp Lys Val Trp Ile

1155

1160

1165

Glu Ile Gly Glu Thr Glu Gly Thr Phe Ile Val Asp Ser Val Glu Leu

1170

1175

1180

Leu Leu Met Glu Glu

185